WORK PLAN
TO PERFORM A
SOIL GAS SURVEY

JOHNSON CONTROLS
315 SOUTH SEVENTH AVENUE
INDUSTRY, CALIFORNIA
(LARWQCB FILE NO. 102.052)

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Prepared for:

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Section 1

INTRODUCTION

This Work Plan was prepared in response to a request from Triad Geotechnical Consultants, Inc. (TRIAD) to perform a soil gas survey at the Johnson Controls site located at 315 South Seventh Avenue in the City of Industry, California to aid in defining the lateral extent of soil impacted by volatile organic compounds (VOCs).

The proposed scope of work consists of a soil gas survey, including the installation and sampling of thirteen (13) 5-foot soil gas sampling probes and two (2) 15-foot probes. Soil gas sampling sites will be field-checked, and modified, as necessary, to provide the most effective placement of the sampling probes. The property owner will be responsible for locating probe sites and clearing probe sites of buried obstructions, including utilities.

Section 2

OBJECTIVES OF THE SOIL GAS SURVEY

The objectives of the proposed soil gas survey are to:

- Aid in identifying vadose zone source areas of (VOCs).
- Assess the lateral and limited vertical extent of shallow soil contamination by VOCs.
- Supply data to aid in the effective placement of soil borings, if necessary.
- Aid in assessing the evaluation and design of remedial action alternatives including excavation, bioremediation, and vapor extraction, if necessary.

Soil gas sampling is limited in its applications and results are dependent on site-specific conditions. Some factors affecting the distribution of VOCs in the subsurface are listed in Appendix A.

Section 3

RATIONALE FOR THE LOCATIONS OF SAMPLING SITES

The soil gas survey will include the installation and sampling of about thirteen (13) 5-foot soil gas sampling probes and two (2) 15-foot probes. Approximate locations of proposed soil gas sampling sites are shown in Figure 1. Soil gas sampling probes will be placed at locations as specified by the LARWQCB.

Suspected source areas to be investigated include the asphalt-paved parking lot adjacent to the Johnson Controls building and areas of VOC-impacted soil, as identified by previous investigations by TRIAD.

Section 4

METHODS AND PROCEDURES

This section describes the methods and procedures to be used to conduct the proposed soil gas survey. Some procedures may be modified and revised based on final evaluation of project needs. Modifications to these procedures, if any, will be described in the soil gas survey report.

Soil gas samples will be obtained using a perforated stainless-steel soil probe, Teflon™ tubing, a vacuum pump, and an instrumentation assembly. Analysis of soil gas samples will be conducted immediately following sample collection.

4.1 PROBE INSTALLATION

Soil gas sampling will be conducted using a general grid-spacing. A typical soil gas sampling probe is shown in Figure 2. Probes will be installed using a percussion hammer. Once the probe has been installed to the desired depth, the probe shaft is withdrawn, leaving the probe point and teflon sampling tube in the soil. A small amount of silica sand will be poured into the probe hole. The remaining open probe-hole will be back-filled with hydrated bentonite grout to the ground surface. The probe point and sampling tube assembly will be left as a long-term soil gas monitoring point and will be completed flush with the ground surface. This will allow subsequent soil gas sampling and analysis, if desired.

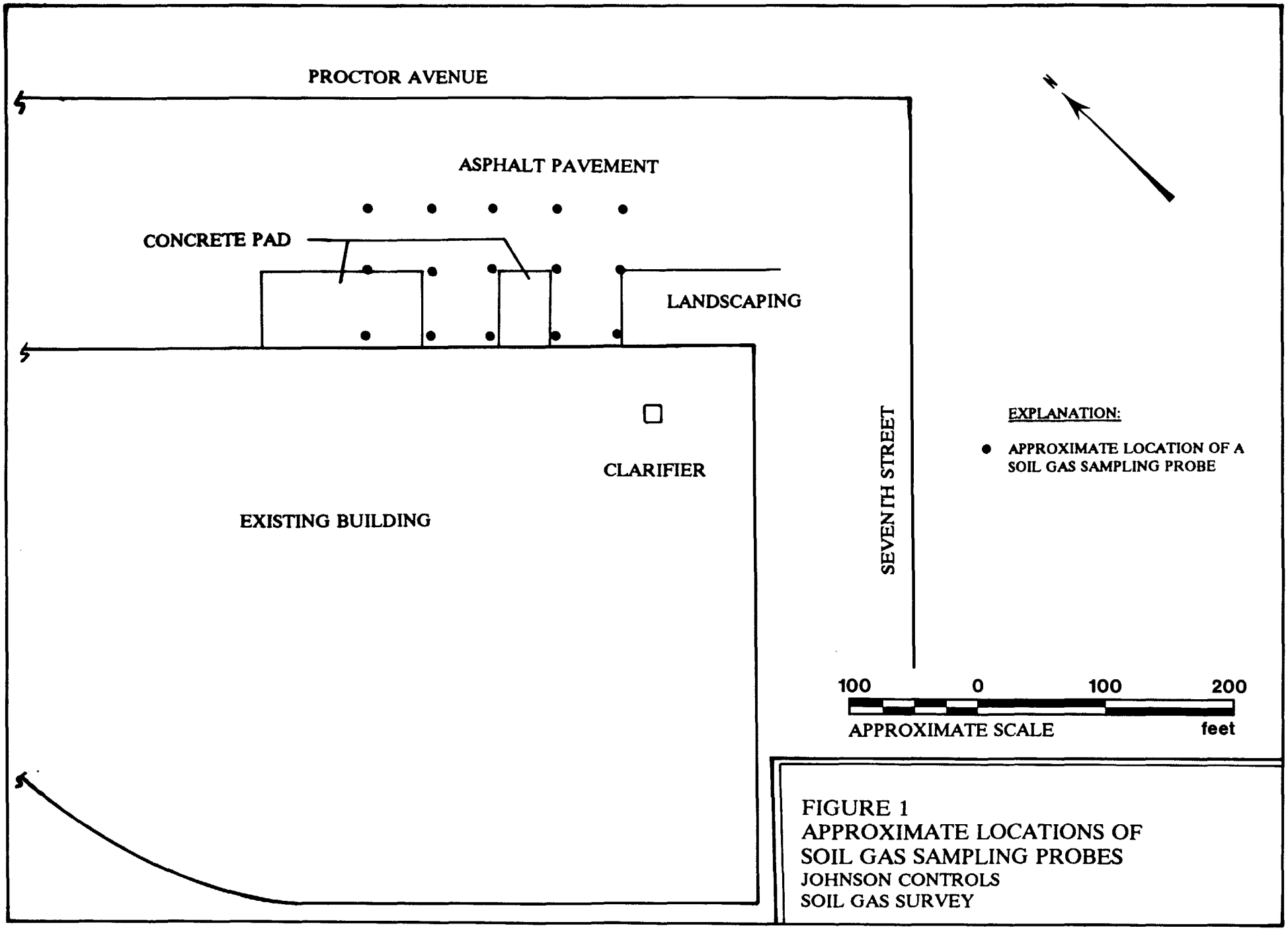


FIGURE 1
APPROXIMATE LOCATIONS OF
SOIL GAS SAMPLING PROBES
JOHNSON CONTROLS
SOIL GAS SURVEY

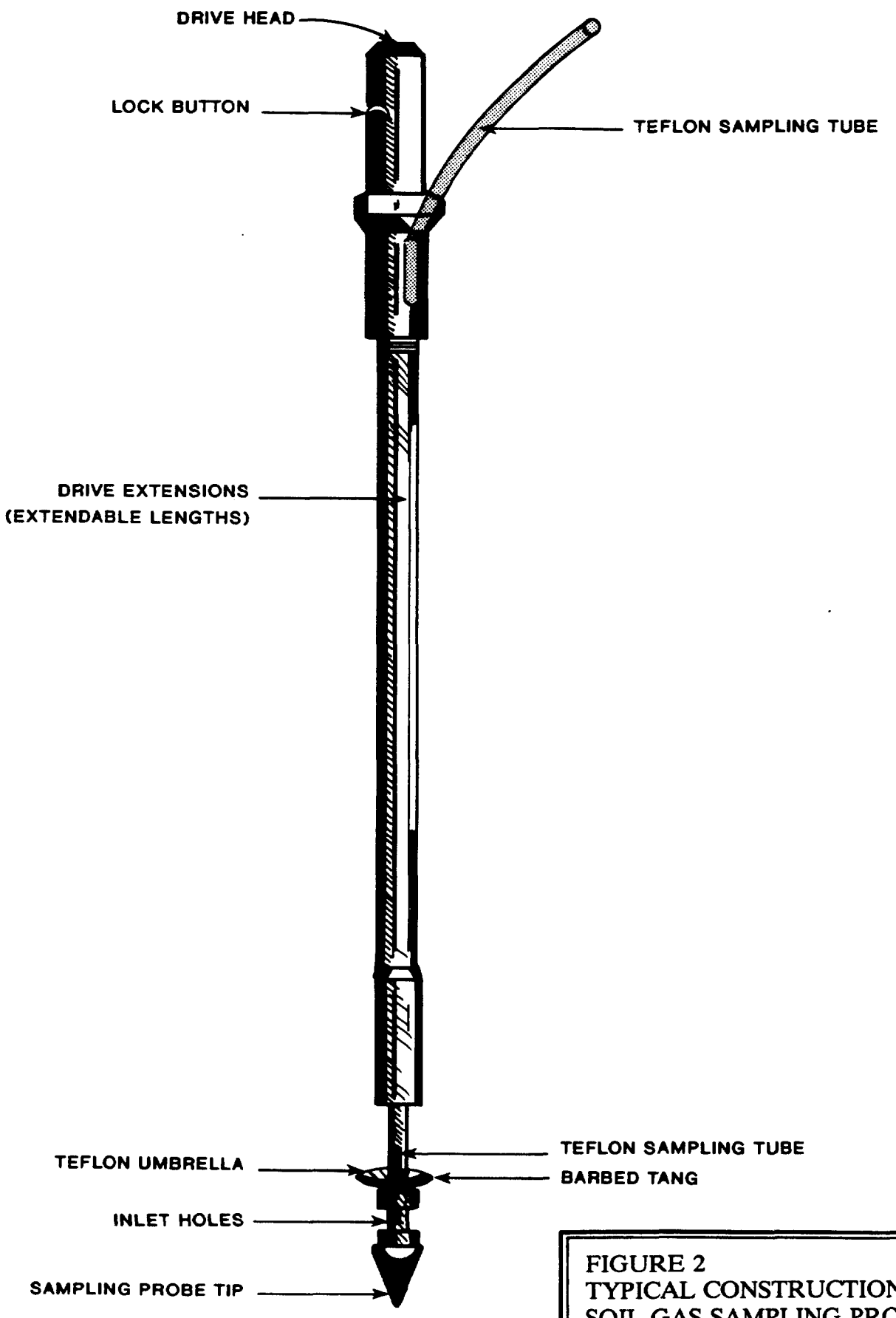


FIGURE 2
TYPICAL CONSTRUCTION OF A
SOIL GAS SAMPLING PROBE
JOHNSON CONTROLS
SOIL GAS SURVEY

4.2 SAMPLE COLLECTION AND HANDLING

Soil gas samples will be collected using a soil gas sampling system as shown in Figure 3. Initially, site-specific probe purging and sample volume calibrations will be performed to evaluate the appropriate volume of gas to be purged from each probe prior to sample collection. This will be done by performing time-series sampling of at least two probes to evaluate trends in soil gas concentrations as a function of purge volume. Soil gas samples will be analyzed in the field immediately following collection. Soil gas samples will be analyzed by direct gas injection into a laboratory-grade, field-operable gas chromatograph.

4.3 SAMPLE ANALYSIS

Soil gas samples will be analyzed in the field using one or more field-operable gas chromatograph(s) equipped with a photo-ionization detector (PID) and an electrolytic conductivity detector (ELCD) in series. Soil gas samples will be analyzed for selected EPA Method 8010/8020 compounds, including halogenated hydrocarbons and benzene, toluene, ethylbenzene, and total xylene (BTEX). Detection limits for the EPA Methods 8010/8020 compounds are normally about 1.0 microgram per liter (μg/l) of gas.

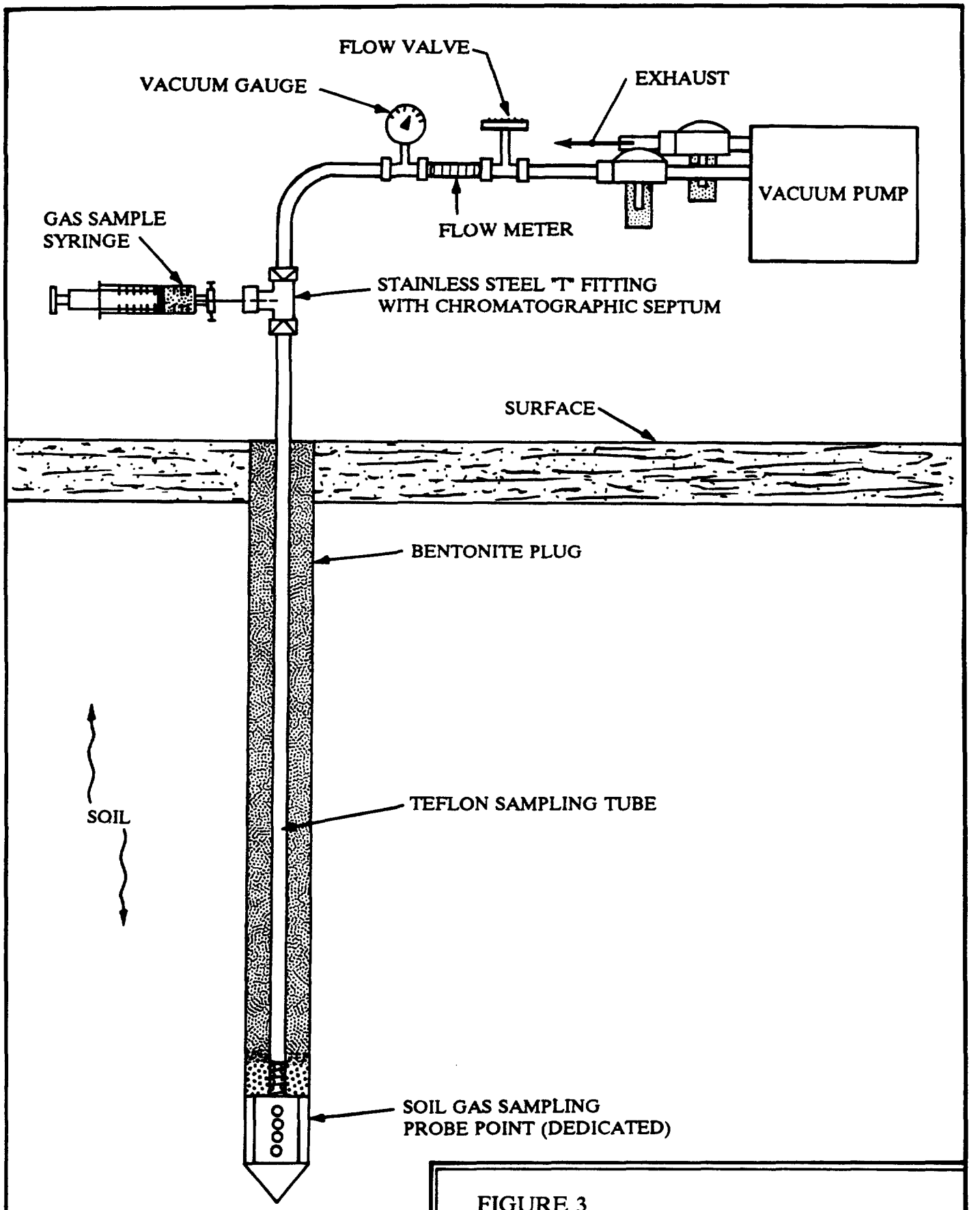
4.4 EQUIPMENT CALIBRATION

The chromatographic equipment used for soil gas analyses will be calibrated using gas standards. Calibration using gas standards will be performed using varying injection volumes of one gas standard of known concentration or using gas standards of varying concentration prepared by serial dilution. Gas standards of varying concentration will be prepared by introducing a known volume of stock gas into a container of known volume.

The gas chromatograph will be calibrated prior to the first sample analysis of the day and after every tenth soil gas sample. Initial calibration (typically performed at the office the prior day) will consist of three injections to establish a three-point calibration. Subsequent field calibration episodes will consist of at least one injection of the standard exhibiting a similar detector response as that of samples encountered in the field.

4.5 DECONTAMINATION

Soil gas sampling probes and tubing in contact with the soil gas sample stream are dedicated to each soil gas sampling location. The sample collection "T-fitting" will be decontaminated prior to initiation of sampling. Decontamination of soil gas sampling



NOTE: NOT TO SCALE

FIGURE 3
SOIL GAS SAMPLING SYSTEM
JOHNSON CONTROLS
SOIL GAS SURVEY

equipment will be conducted by repeated washing and/or by baking in the gas chromatograph oven. Washing will include the use of a phosphate-free detergent wash, tap water rinse, and air drying. The sample collection system consists of stainless-steel and Teflon™. Portions of the system in contact with the soil gas sample stream will be decontaminated prior to sampling each probe. Each soil gas sampling syringe shall be blanked with helium gas before use. Syringes and adapters will be cleaned with phosphate-free detergent at the end of each day and baked overnight in the gas chromatograph oven at a minimum temperature of 60°C.

4.6 QUALITY ASSURANCE/QUALITY CONTROL

A blank sample is obtained by filling the syringe used for soil gas sample collection with ambient air or ultra-high-purity carrier-grade gas from a compressed gas cylinder or ambient air. The high-purity gas or ambient air is then injected directly into the gas chromatograph. This sample injection serves as a blank to detect contamination of the syringe to be used for sampling.

Section 5

REPORT PREPARATION

A report will be prepared describing the results of the soil gas survey. This report will include:

- Description of modifications made to the sampling and analysis methods provided in this proposal.
- Soil gas concentration data in tabular form and presented as isoconcentration contour maps (for commonly detected VOCs and where sufficient data are available).
- Interpretation of soil gas concentrations.
- Assessment of soil gas concentration data to aid in identifying potential vadose zone VOC source areas.
- Recommendations for additional soil gas sampling and/or soil boring and well locations, if necessary.

A draft report on the soil gas survey will be submitted to TRIAD for review and comment. Appropriate revisions will be made and copies of the final report will be submitted to TRIAD for subsequent submittal to the LARWQCB.

APPENDIX A

FACTORS AFFECTING THE GAS-PHASE DISTRIBUTION OF VOCs IN THE SUBSURFACE

Soil and groundwater contamination by volatile organic compounds (VOCs) can often be detected by analyzing trace gases in soils just below ground surface. This technique is possible because many VOCs will volatilize and move by molecular diffusion, away from source areas toward regions of lower concentrations. A gas phase concentration gradient from the source to adjacent areas is established.

The following factors affect the transport and gas phase distribution of VOCs in the subsurface.

1. The liquid-gas partitioning coefficient of the compounds of interest (the "volatility" of the compound).

2. The vapor diffusivity, which is a measure of how quickly an individual compound "spreads out" within a volume of gas.

3. Retardation of the individual compounds as they migrate in the soil gas. Retardation may be due to degradation, adsorption on the soil matrix, tortuosity of the soil profile, or entrapment in unconnected pores.

4. The presence of impeding layers, wetting fronts of freshwater, or perched water tables between the regional water table and ground surface.

5. The presence of contaminants from localized spills or in the ambient air.

6. Movement of soil gas in response to barometric pressure changes.

7. The preferential migration of gas through zones of greater permeability (e.g. natural lithologic variation or back-fill of underground utilities).

At most sites, many of these factors are unknown or poorly understood. Due to this uncertainty, soil gas sampling should be considered in conjunction with other data.